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## ON THE NAMING OF COLORS.

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The ancients, as is well known, had comparatively few color names and used these loosely. This deficiency does not necessarily mean an inability to discriminate colors, nor does an increase in color vocabulary mean an increase in the nicety of discrimination. The completeness of the color vocabulary depends rather on the extent of the social needs of designation. The color names of savage and semi-civilized peoples of the present day have been found to be quite defective, though their powers of discrimination are exceedingly fine.

Our own system of color names and their application leave yet a good deal to be desired. Efforts have been made at various times to introduce arbitrary standards, but none has been widely accepted, except the designation of the standard hues by the corresponding wave-lengths in the spectrum or by reference to the Fraunhofer lines. For the purples, grays, and the multitude of tints and shades this, of course, makes no provision.

On the other side of the question—the precision with which color names are now actually applied—a few observations have been made and at least one experimental study has been carried out.

Prof. H. K. Wolfe<sup>1</sup> made an investigation of the color vocabulary of school children. The children were asked to name colors which were shown to them. The colors used were oil pigments applied by means of a brush to cardboard, previously treated with a coating of glue. Comparison was made on the basis of age and not of class standing. The answers of those deficient in color vision were classified by themselves. The results were then tabulated, giving the correct answers in 1,000. Males and females were classified separately. Colors are named in an entirely different order from that given by Preyer. Tables are given showing the rate and time of improvement, also sex differences. Many colors are absurdly named, and the conclusion is that the color instruction has been very defective.

Our own experiments were in general method akin to those

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<sup>1</sup> H. K. Wolfe: Studies from the University of Nebraska, 1890.

of Wolfe, but carried out upon subjects of a greater range in age. The colors selected for these sets of tests were the twenty-four spectrum colors of the Prang Educational Company. The purpose of the experiments was to see how the colors would be named by school children and college students if left to themselves and not aided by any artificial system. The colors were cut in squares twenty centimeters on the side with a border of black of two centimeters in width. These colors were held up before the various classes in a good light, direct sunlight being avoided. The pupils observed the colors and wrote their answers independently on paper. In the lower primary grades where the children were unable to write they were questioned independently, out of the hearing of the other pupils. In other respects the tests were exactly the same as in the other grades. The colors were purposely arranged in the order of every sixth, *i. e.*, if we represent the colors of the Prang system by the numerals 1, 2, 3, . . . 24, the order in which the colors were presented would be 1, 7, 13, 19; 2, 8, 14, 20, etc., . . . 24. The colors were each exhibited for about one second. A considerable number of names were given, including the names given to various colored fabrics, the colors of flowers, of plants and of concrete objects, such as brick-red, etc., but all of these together form a very small percentage of the whole number of answers. It was, therefore, thought best to classify these under the headings of red, yellow, orange, green, blue, and purple.

The first of the following tables gives the measurements of the Prang colors in terms of the five color standards used in the Physical Laboratory at Columbia University. Thus 90° of the first red of the Prang series plus 10% of white matches 57% of the Columbia red, plus 6.7% of the Columbia blue, plus 36.3% of black.

The later tables give the percentages of answers for each of the colors for the kindergarten pupils and for the whole number of subjects tested.<sup>1</sup> The accompanying curves give the latter results in graphic form, the ordinates denoting the percentage of answers for each Prang color and the abscissæ denoting the position of the same color in the spectral color system. This position was determined by estimating the distance between the successive steps in the following way:—A large circle was drawn on which were placed the twenty-four colors in their regular order, from 1 to 24. Then the distances were altered until they seemed to represent the proper differences in color sensation. The estimates were made by seven subjects and the abscissæ used are the averages of the seven estimates.

<sup>1</sup>The percentages for the kindergarten year only are here given separately as there are no striking differences among the other years.

*Measurements of Prang Colors. Columbia Standards.*

Prang Colors.	R.	O.	Y.	Y.	B.	BK.	W.
90 R 10 W	57.0	.....	.....	.....	6.7	36.3	.....
96 R R O 4 W	100.0	.....	.....	.....	.....	.....	.....
98 R O 2 W	86.4	13.6	.....	.....	.....	.....	.....
100 R O	50.0	50.0	.....	.....	.....	.....	.....
100 O	.....	71.8	8.4	.....	.....	14.4	5.4
100 O Y O	.....	61.7	26.3	.....	.....	6.7	5.3
100 Y O	.....	40.5	42.5	.....	.....	10.2	6.8
100 Y Y O	.....	18.7	77.3	.....	.....	.....	4.0
94 Y + 6 BK	.....	.....	81.2	18.8	.....	.....	.....
84 Y Y G + 16 BK	.....	.....	47.0	53.0	.....	.....	.....
98 Y G + 2 W	.....	.....	28.3	71.5	.....	0.2	.....
100 G Y G	.....	.....	11.6	56.6	.....	31.8	.....
100 Y	(R .644)	.....	2.1	39.9	.....	58.0	.....
100 G B Y	(O .614)	.....	.....	27.7	-9.6	62.7	.....
100 B G	(Y .585)	.....	.....	29.4	28.2	42.4	.....
100 B B G	(G .518)	.....	.....	23.6	67.2	8.8	0.4
62 B + 38 BK	(V .452)	.....	.....	-4.8	88.1	.....	7.1
100 B B V	.....	.....	.....	2.4	92.7	2.9	2.0
100 B V	1.9	.....	.....	.....	56.6	41.5	.....
100 V B V	4.3	.....	.....	.....	45.2	50.5	.....
100 V	7.1	.....	.....	.....	38.6	54.3	.....
99 V R V	12.0	.....	.....	.....	14.1	73.9	.....
96 R V + 4 W	19.8	.....	.....	.....	8.8	71.4	.....
90 R R V + 10 W	38.7	.....	.....	.....	4.7	56.6	.....

*No. of Experiments, 48-53. Kindergarten Pupils. Av. Age 5.*

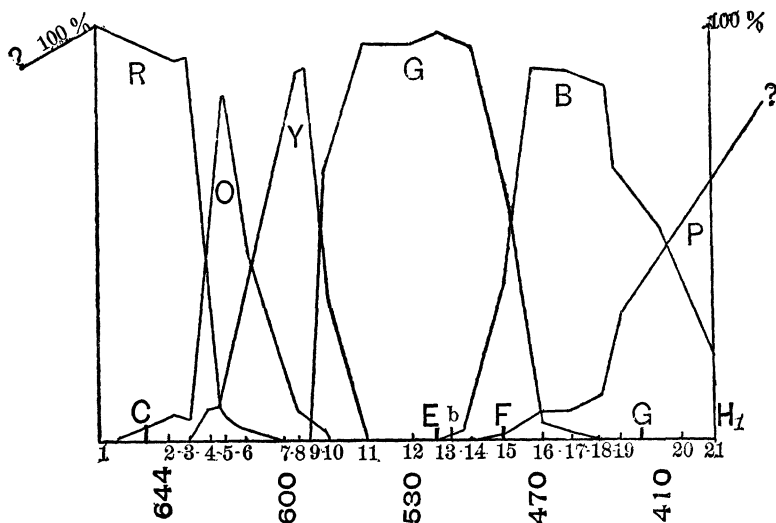
No.	Name.	Red.	Orange.	Yellow.	Green.	Blue.	Purple.
1.	R	100	.....	.....	.....	.....	.....
2.	RRO	97.8	2.2	.....	.....	.....	.....
3.	RO	95.7	4.3	.....	.....	.....	.....
4.	ORO	37.0	48.2	12.8	.....	.....	.....
5.	O	14.0	50.0	36.0	.....	.....	.....
6.	OYO	5.0	57.4	37.6	.....	.....	.....
7.	YO	3.0	31.0	66.0	.....	.....	.....
8.	YYO	.....	12.0	88.0	.....	.....	.....
9.	Y	.....	11.0	84.0	5.0	.....	.....
10.	YYG	.....	.....	40.5	51.0	8.5	.....
11.	YG	.....	.....	5.5	96.0	8.5	.....
12.	GYG	.....	.....	3.3	89.2	7.5	.....
13.	G	.....	.....	3.3	84.9	11.8	.....
14.	GBG	.....	.....	.....	88.0	12.0	.....
15.	BG	.....	.....	.....	67.2	32.8	.....
16.	BBG	.....	5.5	.....	11.0	83.5	.....
17.	B	.....	6.0	.....	3.5	90.5	.....
18.	BBY	.....	6.5	.....	1.5	90.5	1.5
19.	BY	.....	.....	.....	.....	94.0	6.0
20.	YBY	.....	.....	.....	.....	70.5	29.5
21.	Y	8.0	.....	.....	.....	54.0	38.0
22.	YRY	21.6	.....	.....	.....	31.8	40.3
23.	RY	74.4	.....	.....	.....	12.8	12.8
24.	RRY	87.2	.....	.....	.....	.....	.....

*Averages of all Experiments.*

No. of experiments, 1,573.

Ages, 5 to 24 years.

No.	Name.	Red.	Orange.	Yellow.	Green.	Blue.	Purple.
1.	R	97.1	0.9				
2.	RRO	93.9	6.1				
3.	RO	96.8	3.2				
4.	ORO	19.2	80.8				
5.	O	4.4	95.6				
6.	OYO	0.8	41.1	58.1			
7.	YO		25.2	74.8			
8.	YYO		8.3	91.8			
9.	Y		1.9	98.1			
10.	YYG			23.6	76.4		
11.	YG			3.8	96.2		
12.	GYG			2.9	97.1		
13.	G				99.8	0.2	
14.	GBG				97.2	2.8	
15.	BG				58.1	41.9	
16.	BBG		0.4		2.4	97.2	
17.	B		0.5			93.0	6.5
18.	BBV		0.6			84.2	15.2
19.	BV					69.2	30.8
20.	VBV					66.1	
21.	V	5.3				31.7	63.0
22.	VRV	29.4					70.6
23.	RV	92.6					7.4
24.	RRV	98.1					1.9

*Miscellaneous.*

As points of special interest in the curves may be noticed the somewhat broad range of colors that were almost always denominated "red," "green" or "blue." For "orange" and "yellow" the total range is perhaps nearly as great, but the high frequency of usage is confined within extremely narrow limits. Another item is the sharpness of the demarkation in the usage of "green" on the side toward red as compared with its wide range on the side toward blue, corresponding to the common uncertainty of "telling green from blue." In a somewhat similar fashion "blue" and "purple" overlap. It is also interesting to notice that the pair "blue" and "yellow" do not overlap at all, though they might perhaps be expected to do so, if it were actually possible to see in green a mixture of yellow and blue as some have thought could be done. A similar, though smaller, gap separates the usage of the names "red" and "green." "Green" and "purple" (here equivalent to violet probably) were, however, applied to identical colors by different individuals.